NREL
Guidelines for Subcontractor Reports

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NREL Guidelines for Subcontractor Reports

This booklet can help you report to DOE NREL on the results of your work. It is meant as a guide, so sometimes the style and format you use in your report might differ from the one shown here. The differences sometimes depend on your subject matter, your technical or scientific area, the equipment you use to prepare your report, and the terms of your contract.

Whenever possible, however, try to use the format described and demonstrated in this booklet as a guide to the layout and design of your report. For example, NREL reports are usually single-spaced on 8-1/2 × 11 paper with 1-inch margins all around, in block paragraphs without indents. For text, we use 11- or 12-point Times Roman or a similar serif font. Reports are divided into sections rather than chapters. Main headings, most subheadings, and figures and tables are usually printed in sans serif fonts, such as 10-, 11-, and 12-pt. Helvetica, Arial, Univers, and other similar fonts. We leave a blank line around headings, figures, tables, and equations and between paragraphs. See the topic headings inside this guide for suggested font sizes, heading styles, and other formatting information.

These guidelines are based on the fourth and fifth editions of the *NREL Style Guide* (NREL/MP-330-24935; www.nrel.gov/docs/gen/fy01/24935.pdf). If you have questions about the guide, please contact your technical monitor, who may also refer you to a member of NREL's Communications Office staff.

These are the topics covered in this guide; they appear in alphabetical order and include examples:

> abbreviations; academic titles; acronyms; active & passive voice; bullets; capitalization; captions and subcaptions; chemical terms; data in tables; degree symbol; dollars; electronic document citations; equations; figures; fiscal year; fonts, headings, & subheadings; fractions; italics; lists; mathematical symbols; margins and page numbers; metric conversions; multiplication symbols; non-SI units; numbers; parentheses; %, percent, & percentage; personal pronouns; pressure; ratios; references; report elements; scientific notation; SI (metric) system; solidus; sources; standard errors; tables; temperature; time; units of measurement; zero

Please see also the bibliography at the end of this guide for suggestions for further reading.

Technical Style Guidelines

Abbreviations

To avoid confusion, spell out an abbreviation in full or define it the first time you use it, unless you're sure all your readers know what it means. Most readers of technical reports and papers are familiar with the common technical abbreviations used in their discipline (cm, m, Hz, kW, rpm), so you can abbreviate them without definitions.

Spell out a technical abbreviation in full in text when you use it without numerals. For example, write "a few centimeters" rather than "a few cm." Otherwise, use abbreviations consistently throughout. In brochures, exhibits, and other products intended for a wide audience, use as few abbreviations as possible. If your product contains many abbreviations and acronyms, add a list of definitions, glossary, or nomenclature. For more information, see also Pacific Northwest National Laboratory's online guidelines for authors at this address:
www.pnl.gov/ag/usage/acronym.html

Abbreviating Measurement Units

Abbreviate most units of measurement:

900 W/m^2
43 cm
60 Hz

Define measurement units if they might confuse some readers. Spell the term out first, and follow that with the abbreviation in parentheses; thereafter, you may use the abbreviation:

250 hectares (ha)

Spell out units of measurement when they're not accompanied by numbers:

The new film was several nanometers thicker than the previous one.

Abbreviating Names

When you first use them, spell out the abbreviations of professional societies, organizations, processes, technical equipment, and long chemical terms:

American Society for Testing and Materials (ASTM)
National Fire Protection Association (NFPA)
public utility commissions (PUCs)
chemical vapor deposition (CVD)
compact vacuum insulation (CVI)
chlorofluorocarbons (CFCs)

Use a small *s* (no apostrophe) for plurals of abbreviations (PUCs and CFCs, not PUC's or CFC's); for plurals of units of measurement, omit the *s* (e.g., 15 cm, 6 m, 5 million Btu, 75 dB, 40 W).

To abbreviate World Wide Web, use *the Web,* rather than *WWW*, after writing the name out in full the first time you mention it.

Abbreviating Report Elements

You can abbreviate *equation* and *reference* when you use them with numbers, but spell them out at the beginning of a sentence:

> See Eq. 1-1, Eq. 2-7, and Ref. 10.
> Equation 2-1 shows the relation.

See also **acronyms** and **units of measurement**.

Academic Titles

Omit professional and academic titles like *doctor* and *professor* and their abbreviations (Ph.D.) in technical reports, unless you are referring to an M.D. See also *references*.

Acronyms

An acronym is an abbreviation or "initialism" that is pronounced as a word:

RAM	OPEC
NASA	NORAD

Some common acronyms are no longer capitalized:

laser radar sonar

Spell out capitalized acronyms when you first use them, and put the acronym in parentheses after the full name. To avoid confusing readers, don't use too many acronyms and abbreviations in any one sentence or paragraph. Include a glossary or list of acronyms if your publication contains a lot of them.

Here are some guidelines for using *a* and *an* with acronyms and other words: use *a* before any acronym or word beginning with a consonant sound. Use *an* before any acronym or word beginning with a vowel sound, whether or not the acronym or word actually begins with a vowel or a consonant. Note that an acronym or abbreviation can be pronounced as a word (for example, a HEPA filter), or as its letters (for example, an NGO), and it is the first sound of the word or letters that shows you whether to use *a* or *an.* Examples: a light-water reactor, an LWR; a Human Resources Office memo, an HRO memo; a nongovernmental organization, an NGO; a National Renewable Energy Laboratory subcontract, an NREL subcontract.

Active Voice and Passive Voice

Try to write more active-voice sentences than passive-voice sentences. In other words, the subject of most of your sentences should be the "actor" or "agent" (who did it?) rather than the thing "acted upon":

> Active voice: We tested the apparatus.
> Passive voice: The apparatus was tested by us.

Research has shown that active voice helps even highly educated readers absorb information more quickly than passive voice does. Passive voice is no longer considered to be more scholarly or scientific than active voice. Active voice also lends clarity and vigor to technical writing. But passive voice can be appropriate when it's more important to emphasize what was done than who did it. Passive voice adds variety to your writing, too. See also *personal pronouns*.

Bullets

Bullets are usually printed as solid, centered dots to the left of items in a list. You need to have at least two items in a bulleted list. Set off subordinate items with a different symbol, such as a hyphen or an open bullet:

- Make bulleted lists parallel in construction (that is, begin all the items in the list with the same part of speech, such as a verb or a noun).
    - Make sure all items are either phrases or complete sentences.
    - Punctuate all items consistently.
- Use bulleted lists to highlight important items, draw attention to main points, or list information so readers can find it easily.
- Use numbered or lettered lists instead of bullets if you want to refer to items in a list or procedure elsewhere in the text.
- Begin each item with a capital letter; omit ending punctuation unless the item is a complete sentence or the last item in the list.
- Use bulleted lists sparingly to call attention to the information in them.

Capitalization

Capitalizing Proper Nouns

Capitalize proper names. These include the names of government programs, official projects, formal groups, organizations, companies, titles (when they precede a name; except for the President of the United States, use lowercase in titles that follow the name), specific geographic areas or features, and ethnic groups:

> the Alcohol Fuels Program
> the Ethanol Project
> the Human Resources Office
> the U.S. Bureau of Mines

BP Solar
World Wide Web (the Web); the Internet
President Carter
Christine Johnson, president and chief executive officer
the Southwest
Lake Powell
the Colorado River

Capitalizing States and Titles

Capitalize the names of states, but capitalize the word *state* only when it appears with the entire official name:

the State of Colorado; Washington State

Capitalize titles (Vice President Gore) when they precede a name. Lowercase titles when they follow the name, except for the President of the United States:

Mary Jones, the president of the company
John Smith, the chair of the committee

Capitalizing Table Titles, Headings, and Captions

Capitalize the main words of table titles and most headings and subheadings, including the second word in a hyphenated term (e.g., *PV Program Five-Year Plan*). Do not capitalize articles (a, an, the) unless they begin the title or heading; conjunctions (and, or, nor, but); prepositions (for, of, to); or symbols, special terms, and abbreviations that are usually not capitalized.

Sample table title in 10 pt. Arial bold:

Table 1. Number and Frequency of Defects Found in Six Samples
(May–June 2002)

Sample subheadings in 12 pt. Arial bold (first-level subheading) and 11 pt. Arial bold italic (second-level subheading):

Testing the 7.6-m Blades

Results of Laboratory Fatigue Tests

Results of Field Tests

Capitalize only the first word and proper nouns in figure captions. Here is a sample in 10 pt. Arial bold:

Figure 1. Schematic of the NREL prototype electrochromic window

Capitalizing Taxonomic Names

In writing about botanical and zoological divisions, capitalize the names of all divisions higher than species: genera, families, orders, classes, and phyla. Print genera, species, and varieties in italics:

Clostridium thermocellum
Escherichia coli

After you first mention them (and spell them out), you can abbreviate most generic names followed by species names:

C. thermocellum
E. coli

You may omit the capital and the *italics* (see) when referring to a genus in a general way. If you can't print these words in italics, use underlining instead.

Capitalizing Trade Names

Capitalize trade or brand names. You may include a trademark, copyright, or other symbol when you first mention the official name and the symbol is part of that trade name; thereafter, you may omit the symbol:

Pyrex® Kleenex

Refer to the company's literature or stationery if you're not sure. See also an online checklist like this one for information on trademark usage: www.inta.org/tmcklst1.htm

Captions

Begin figure and photo captions with a capitalized word and use lowercase thereafter, except for proper nouns and capitalized abbreviations; unless you add a subcaption, you don't need a period at the end of a caption. Print captions in bold; print subcaptions (which include supplementary information) in the regular form of that font:

Figure 2-1. Photoconductivity spectra of a composite CIS thin film
(Inset is a probable energy band diagram)

Chemical Terms

Do not use a hyphen in most chemical expressions, even when the terms are used as modifiers:

carbon dioxide levels
hydrogen ion activity

Use a hyphen after prefixes when it is the standard for certain chemical formulas:

L(+)-2, 3-butanediol, *trans*-glycol

Use a hyphen to indicate mixtures or combinations:

hexane-benzene

Data in Tables

Place a zero to the left of the decimal in any number less than 1 in both text and tables (0.5; 0.039). Align columns of data vertically on the decimals. When the units of measurement for the data are different, however, alignment is not necessary (but be sure to specify the units).

Degree Symbol

Print the degree symbol right next to the symbol for the temperature scale:

36°C, 85°F

Repeat the degree symbol in ranges:

32°–36°C

Express kelvins as K rather than as °K; leave a space before the K:

85 K

Dollars and Cents

Express thousands of dollars this way, using a comma:

$5,000 $10,280

Express millions and billions of dollars this way:

$3 million $1.2 billion

Use a dollar sign to express costs under $1.00:

$0.25; $0.06 per kilowatt-hour (or $0.06/kWh)

Electronic Document Citations

See *references*. See also online good guides from Columbia University Press and IFLANET.

Equations

Make sure that all the terms in your equations are defined and used consistently both in the text and in subsequent equations, figures, and tables; here's an example:

The conductive heat flow equation is

$$dQ/dt = AKdT/dx ,$$

where

dQ/dt	=	the time rate of heat transfer
A	=	the area of an end contact
K	=	the thermal conductivity
dT/dx	=	the thermal gradient.

Figures

Figures can be line drawings, graphs, charts, diagrams, schematics, flow charts, illustrations, and photographs. Use a consistent sans serif font (such as a 10 pt. regular Arial, Helvetica, or Univers) and line weights in drawings. Make sure all figures are readable and easy to reproduce. Use a 10 pt. bold sans serif font for captions; capitalize only the first word and proper nouns. Number figures in simple sequence in a brief report or paper (Figure 1, Figure 2). In longer reports, papers, or chapters, include section or chapter numbers in the figure numbers (Figure 1-1, Figure 1-2, Figure 2-1, and so on). Make sure the data in the figures match the data in text and tables.

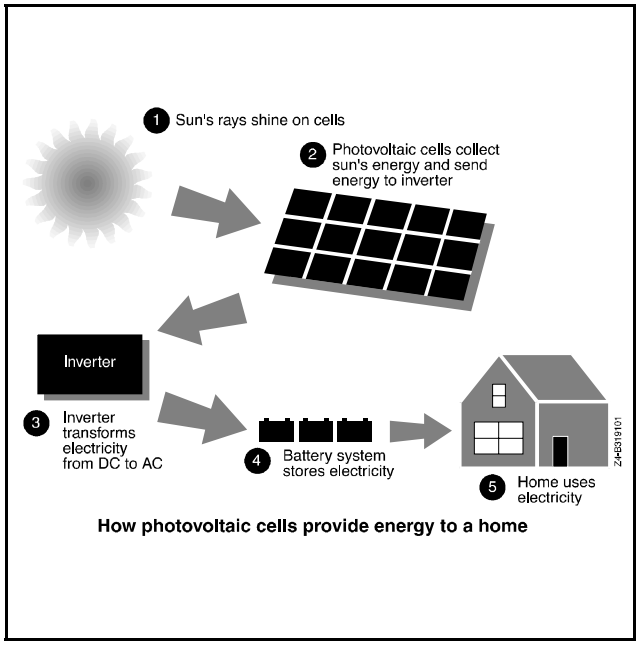

Figure 2-1. Photovoltaic cells use sunlight to provide energy to a home

Fiscal Year

Spell out *fiscal year* (no capitals) the first time you use it, unless all your readers will know what the abbreviation means. After that, you can abbreviate it; FY 2005 is preferable to FY05.

Fonts, Headings, and Subheadings

The text of a report is usually 11 or 12 pt. Times Roman or Times New Roman, or a similar serif font. Section headings (similar to chapter headings) are usually printed in a large, bold, sans serif font (at least 14 points or larger) such as Arial, Helvetica, or Univers bold. First-level subheadings are 12 pt. sans serif bold and second-level subheads are 11 pt. sans serif bold italic. Here is the standard format for four levels of report subheadings:

> **First-Level Subheadings: 12 pt. Arial Bold**
> ***Second-Level Subheadings: 11 pt. Arial Bold Italic***
> *Third-Level Subheadings: 11 pt. Arial Italic*
> Fourth-Level Subheadings: 12 pt. **Times Roman Bold** or *Italic*. (Begin text on the same line after this subheading; the subheading is followed by a period.)

You can number headings and subheadings (1.0, 1.1, 1.2, 2.0, etc.) if that will help your readers follow the text in your report more easily.

Fractions

Use words instead of numerals for simple fractions in text:

> a third of the way, one-fifth its actual size, three-fourths of the participants

Write out complex fractions with numerals separated by a solidus:

> 1/64
> 23/32
> 5-1/2 days afterward
> 2-1/2 times greater

Display complex, built-up fractions by centering them vertically between two parts of a paragraph:

$$\ln\left(\frac{N_c}{n} \times \frac{\eta}{1-\eta}\right)$$

Place a zero to the left of the decimal in fractions less than 1:

> 0.125

0.006

See also *equations*.

Internet Document Citations

See *electronic document citations* and *references*.

Italics

Italics are available for most printers and in most word-processing and desktop publishing software. If you can't print an italic font, however, you can substitute underlining.

Use Italics for Emphasis

Use italics (sparingly) rather than bold to emphasize a word or phrase or bring attention to it:

Never operate this equipment when it has a yellow "danger" tag.

Use Italics for Foreign Words and Phrases

Italicize such foreign words and phrases as *in situ*, *in vivo*, and *inter alia*; if the word or phrase is commonly used in your field, however, you may omit the italics.

Use Italics for Hyphenated Prefixes

Italicize hyphenated prefixes (such as *cis*-, *trans*-, *o*-, *m*-, and *p-)* to chemical formulas:

trans-1, 2-dibenzoylethylene
trans-glycol

Use Italics to Cite Published Documents

Use italics in references, footnotes, and bibliographies for book and report titles and the names of journals and magazines:

Gone with the Wind
FY 1999 Annual Report
Applied Physics Letters
Science

But print the titles of articles in journals and magazines in regular Roman type and in quotation marks:

"Solar Chimney Theory: Basic Precepts"

Use Italics in Taxonomic Names

Use italics for genera, species, and varieties:

> *Clostridium thermocellum*
> *C. thermocellum*

Omit the capital and the italics when you are referring to a genus in a general way:

> In this environment, the clostridium does not produce glucose.

Using Italics in Referring to Words as Words

Italicize a word or phrase when you're referring to it as a word or as a phrase:

> The word *footnote* is often used in place of *reference*.
> He wrote *ambiguous*, but I think he meant *ambivalent*.
> We should print *Handle with Care* on these labels.

Lists

You can use bulleted or numbered lists in NREL publications; the following is an example of a bulleted list:

- Include at least two items in a bulleted or numbered list.
- Use numbered lists only to describe procedural steps and for items referred to elsewhere in text (for example, "as described in step 2").
- Use parallel construction in lists; that is, make all the listed items similar; use sentences or phrases throughout, and begin each item with a verb or a noun.
    - Use different bullets or hyphens for subordinate items in a bulleted list; use lowercase letters for subordinate items in a numbered list (a, b, c).
    - Make sure you have at least two subordinate items in your list.
    - Indent them like this.
- Use punctuation in lists when the items are complete sentences; otherwise, place a period after the last item only.

You can also list a few items or brief procedural steps in a paragraph and number them as follows: (1), (2), (3), and so on. See also *bullets***.**

Margins and Page Numbers

Leave at least a 1-inch margin around your text on all sides, and center page numbers at the bottom of the page. You may place page numbers a half-inch from the bottom edge of the page. Page numbers are usually printed in Times Roman or Times New Roman.

You may also want to start a new page and break the text before the next subheading or paragraph, if that would help you avoid an awkward page or line break. This guide is a fairly good example of NREL's preferred style for margins, page breaks, and page numbering.

Mathematical Symbols

Leave a space on either side of mathematical symbols used as operation signs:

$T_{in} - T_{amb}$ $\quad$ $\quad$ $°C \times 1.8$

The solidus (a/b) or division sign is an exception; spaces aren't used around that symbol. And don't leave a space between numerals and the symbols for degrees, dollars, and percents (32°, $100, 17%). Leave a space between numerals and symbols of measurement like Å. Don't leave a space between symbols like >, <, ≥ and the numeral unless they are the operation signs in an equation.

Measurement Units

See *units of measurement*.

Metric Conversions

For quick online conversions of English units of measurement to metric units, see http://www.digitaldutch.com/unitconverter/ or http://convert.french-property.co.uk/index.htm.

Metric System

See *SI (Metric) System*.

Multiplication Symbols

Be as consistent as possible in using multiplication symbols in your paper or report; as appropriate, choose one symbol (× or •) or omit the symbol and use proximity or parentheses: ab, (ab) (cd), etc.

Non-SI (English) Units of Measurement

Use non-SI or nonmetric units of measurement (English units) instead of metric units only when they are the industry standard. Otherwise, use metric units followed by English equivalents in parentheses:

38.1 m (125 ft)

Numbers

NREL's conventions for using numbers include general rules; rules for alignment; the use of fractions and decimals; precision conventions; guidelines for punctuation, ranges, scientific notation, and spelling; and use with units of measurement.

Use numerals with units of measurement and time:

2-1/2 hours	87 years
4.5 months	6 liters
36 cm	25 kW

For units of time, you can spell out numbers less than 10 if you do so consistently:

five-year plan
two-hour test
three-week turnaround

Use numerals to imply arithmetical values or manipulation:

a factor of 3
multiplied by 2
a ratio of 4:5

Express measurement errors as follows:

6 nm ± 0.2 nm

Leave a space between the number and the unit of measurement (0.2 m) and put spaces around the operation sign; when a measurement error appears by itself, omit the space between the sign and the number:

The measurement error is ±0.2 nm.

Aligning Numbers

Align numbers that share a common unit of measurement on the decimals in columns of tables; put a zero before the decimal in numbers smaller than one:

  0.8
  2.45
187.362

When the numbers in a column of a table do not share the same unit of measurement, you may center the numbers in the column and specify the unit of measurement.

Fractions and Decimals

You can spell out and hyphenate simple fractions (this is preferred in text) or express them, like more complex fractions, in numerals with a solidus:

one-fifth or 1/5 (but not $1/5^{th}$)
1/64 (but not $1/64^{th}$)

Use a hyphen to separate the integral and fractional parts of a mixed number, or convert the fraction to a decimal:

2-1/2 cm in diameter
2.5-cm-diameter solar cell

For numbers of 1 million or more, use the numeral (and a decimal, if necessary) and the words *million*, *billion*, and so on:

1.1 million households
3.5 billion people
$2.5 trillion in funding

Precision and Numbers

Measurement uncertainty analysis calls for precision in measurements to a significant digit to the right of a decimal point, such as two or three digits (hundredths or thousandths). If you're not absolutely sure, check with an expert before changing the number of digits to the right of the decimal, or rounding the numbers. See also *standard errors.*

Punctuating Numbers

Use a comma to separate groups of three digits in numbers:

5,182
113,728
2,225,000

If the numbers do not exceed four digits in text or in a table, you may omit the comma:

3000 solar retrofits per year

But keep the comma for money:

$5,000 in startup costs

Ranges of Numbers

To show ranges, use an en dash (which is a little shorter than an em dash or long dash), a hyphen,

or the word *to* when you use *of* or *from* before the range. To express a range between some number and another number, always use the word *and* (not *to*) with the word *between*:

15%–25%
from 32° to 40°C
6–12 cm
from 66 to 80 V
10–20 m^2
between 10 and 20 m (not "between 10 to 20 m")

Note that symbols like ° and % are repeated in a range.

Scientific Notation

Express multiples of SI (metric) units in powers of 10 with the appropriate prefixes and technical abbreviations:

mm (millimeters, 10^{-3} m)
MJ (megajoules, 10^6 J)

Use standard scientific notation to express very small and very large numbers:

2.5×10^{-3}
3.56×10^6

Use one capital M, rather than MM, for *mega* or *millions*, as in *MW* (for *megawatts).*

Spelling Out Numbers

Except with units of measurement, spell out numbers under 10:

eight experimental runs
three species of yeast

Spell out all numbers at the beginning of sentences:

Fifteen trials later, the results were the same.
Thirty-five participants attended the workshop.

When a sentence contains one or more numbers greater than nine that are related to a smaller number, use numerals for all of them:

The results were the same in 3, 12, and 18 trials.
The contractor tested 8 devices in May, 12 in June, and 9 in July.

Spell out the first of two adjacent numbers unless the first one requires three or more words:

ten 5-kW arrays
thirty-two 4-cm^2 devices
135 2-m collectors

See also *fractions*.

Parentheses

Use parentheses, brackets, and braces in equations in a repeated progression, from parentheses inside to braces outside, as shown below.

Parentheses in Equations

Use parentheses, brackets, and braces in this sequence:

{[( )]}

Parentheses with Measurements

Use parentheses around English measurements that follow SI (metric) measurements:

3.1 m/s (7 mph)

Parentheses in Citations

When you use parentheses in text, such as for author-date references or for parenthetical (added) information, place a comma after the parentheses rather than before them:

In earlier research (Jones 2001), we showed how quantities of lipids could be increased by this method.

%; Percent; Percentage

Use the symbol % with numerals; use the word *percent* when you spell out numbers at the beginning of a sentence. To determine whether *percent* or *%* is singular or plural, look at the noun following it. If the next noun is a plural, use a plural verb; if it's singular, use a singular verb:

The maximum glucose yield was 60%.
Six percent of the *pipes were* rusty.
More than 10% of that *amount was allocated* to planning.

When there is no number, use the word *percentage,* unless people in your field use different terminology, such as *percent difference.*

This table shows percentages of government buildings having solar roofs, by state.

Personal Pronouns

Many people have been taught not to use personal pronouns (*I*, *we, they*) in technical and scientific writing, but most modern style guides (such as the *AIP Style Manual*) recommend using them because they bring clarity to our writing. Personal pronouns prevent confusion by clearly and concisely showing who performed an experiment or procedure (who did what):

> We tested several hundred isolates that were able to ferment glucose.
> We deposited a thin film of doped cadmium on the substrate.

Which of these two sentences is easier to understand quickly?

> (1) It was determined that the workshop was a success.
> (2) Participants agreed that the workshop was a success.

See also *active voice and passive voice*.

Pressure

Use the standard SI unit for pressure or stress, which is the pascal (Pa) or the bar. Non-SI units include psi (pounds per square inch), millimeters of mercury, torr, and atmospheres, and they are still in relatively widespread use.

Ratios

In general, use a colon to indicate a ratio:

> We prepared a 3:1 dilution.

Some industries (such as the American automotive industry), however, use a solidus to express a ratio:

> The engine is designed to have an optimum air/fuel ratio.

References

Professional societies usually specify a style for references in papers published in their journals and proceedings. But if you're preparing a paper or report for NREL or for a publisher that has no prescribed style, you can use one of two basic formats for reference citations in text and the list at the end of your document: numbered references or author-date references (which are preferred at NREL).

Numbered References

Include a numbered reference list, not one sorted alphabetically, if you used reference numbers

[1] in the text of your report or paper. Here are some examples:

Technical paper:
1. Hulstrom, R.L. "Solar Radiation Topical Overview." *Photovoltaics and Insolation Measurements Workshop Proceedings; June 30–July 3, 1985, Vail, Colorado.* SERI/CP-215-2773. Golden, CO: Solar Energy Research Institute, 1985; pp. 1–11.

Journal article:
2. Czanderna, A.W. "Solid Surfaces, Surface Processes, and Solid/Gas Interactions." *J. Vac. Sci. Technol.*; Vol. 17, 1980; p. 72.

Book:
3. Perry, R.H; Chilton, C.H. *Chemical Engineer's Handbook.* 5th edition. New York: McGraw Hill, 1973; pp. 6–14.

Chapter in a book:
4. DeBlasio, R.; Stone, J.; Surek, T.; Emery, K.; Myers, D.; Kroposki, B.; Mrig, L.; Burdick, J.; Czanderna, A.; Strand, T.; Osterwald, C. "Photovoltaic Performance and Reliability," Chapter 5. Boer, K.W., ed. *Advances in Solar Energy: An Annual Review of Research and Development.* Vol. 10, Boulder, CO: American Solar Energy Society, Inc., 1995; pp. 247–345.

Editor and book in a series:
5. Cooper, E.L., ed. *Invertebrate Immunology*. Contemporary Topics in Immunology, Vol. 4, New York: Plenum Publishing, 1974.

Report:
6. Bergeron, P.W.; Riley, C.J. *Wastepaper as a Feedstock for Ethanol Production.* NREL/TP-232-4237. Golden, CO: National Renewable Energy Laboratory, November 1991.

Subcontract report:
7. Whitney, K.A. *Determination of Alternative Fuels Combustion Products: Phase 3 Report.* NREL/SR-540-13594. Work performed by Southwest Research Institute, San Antonio, TX. Golden, CO: National Renewable Energy Laboratory, December 1997.

Patent:
8. Baumann, B.D., et al., U.S. Patent No. 4,771,110, 13 September 1988.

Private communication:
9. Smith, J.Q. Internal memorandum. U.S. Department of Commerce, Washington, DC, 29 February 1988.

Thesis or dissertation:
10. Gossett, J.M. *The Treatment of Refuse for Increasing Anaerobic Biodegradability.* Ph.D. Thesis. Stanford, CA: Stanford University, 1976.

Electronic document:
11. Ivey, K.C. "Untangling the Web: Citing Internet Sources." *The Editorial Eye* online, www.eeicommunications.com/eye/utw/96aug.html. Last modified Mar. 24, 1997; accessed July 3, 1997.

Newsletter article, no author given:
12. "Uses of Petroleum." *Connections: Energy, Environment, Economics and Education Working Together.* Institute of Science and Public Affairs, Florida State University. Vol. 6, No. 3, April 1998; p. 4.

Author-Date References

This is the preferred reference style for NREL reports. If you used author-date citations in text [(Potter and Benson 1991)], order your reference list alphabetically according to the first author's last name. (Note that there is no comma between the names and the publication date in in-text citations.) In your reference list, use the reference style adapted from one used in NREL's Publications Database (http://pix.nrel.gov:8020/basisbwdocs/nrel/homepubn.html) unless your instructions (e.g., from an outside publisher) state otherwise. Examples:

Technical paper:
Potter, T.F.; Benson, D.K. (January 1991). "Non-CFC Vacuum Alternatives for the Energy-Efficient Insulation of Household Refrigerators: Design and Use." Prepared for the 42nd International Technical Conference, May 1991. TP-253-4124. Golden, CO: National Renewable Energy Laboratory, 13 pp.

Journal articles:
Zangrando, F.; Bharathan, D.; Link, H.; Panchal, C.B. (October-December 1990). "Seawater Test Results of Open-Cycle Ocean Thermal Energy Conversion (OC-OTEC) Components." *Heat Transfer Engineering* (11:4); pp. 44–53.

Osorio, R.; Froyen, S.; Zunger, A. (April 1991). "Superlattice Energetics and Alloy Thermodynamics of GaAs/Ge." *Sol. State Communications* (78:4); pp. 249–255.

Books:
Merk, J.S.; Fogg, I.J.; Snowe, C.Q. (1983a). *Meteorologists Handbook*. Chicago, IL: Alwether and Clere.

Book published in same year by same author(s):

_____. (1983b). *Trends in Global Temperatures.* Chicago, IL: Alwether and Clere.

Chapter in a book:
DeBlasio, R.; Stone, J.; Surek, T.; Emery, K.; Myers, D.; Kroposki, B.; Mrig, L.; Burdick, J.; Czanderna, A.; Strand, T.; Osterwald, C. (1995). "Photovoltaic Performance and

Reliability," Chapter 5. Boer, K.W., ed. *Advances in Solar Energy: An Annual Review of Research and Development,* Vol. 10, Boulder, CO: American Solar Energy Society, Inc.; pp. 247–345.

Editor and book in a series:
Cooper, E.L., ed. (1974). *Invertebrate Immunology*. Contemporary Topics in Immunology, Vol. 4, New York: Plenum Publishing.

Report:
Whalen, M; Kelly, K. (1997). *Perspectives on AFVs: 1996 Federal Fleet Manager Survey.* NREL/TP-540-22720. Golden, CO: National Renewable Energy Laboratory.

Subcontract report:
Sidhu, S.; Graham, J.; Taylor, P.; Dellinger, B. (May 1998). *The Origin of Organic Pollutants from the Combustion of Alternative Fuels: Phase V/VI Report.* NREL/SR-540-24134. Work performed by the University of Dayton Research Institute, Dayton, OH. Golden, CO: National Renewable Energy Laboratory.

Patent:
Baumann, B.D., et al., U.S. Patent No. 4,771,110 (13 September 1988).

Private communication:
Smith, J.Q. (29 February 1988). Internal memorandum. U.S. Department of Commerce, Washington, DC.

Thesis or dissertation:
Gossett, J.M. (1976). *The Treatment of Refuse for Increasing Anaerobic Biodegradability.* Ph.D. Thesis. Stanford, CA: Stanford University.

Electronic document:
Ivey, K.C. (Last modified Mar. 24, 1997). "Untangling the Web: Citing Internet Sources." *The Editorial Eye* online, www.eeicommunications.com/eye/utw/96aug.html. Accessed July 3, 1997.

Newsletter article, no author given:
"Uses of Petroleum." (April 1998). *Connections: Energy, Environment, Economics and Education Working Together.* Published by the Institute of Science and Public Affairs, Florida State University. Vol. 6, No. 3; p. 4.

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Report Elements

NREL technical and subcontract reports contain the following elements, as appropriate: cover, title page, preface or acknowledgments, (executive) summary, table of contents, lists of figures and tables, body of report, references or bibliography, and appendices. The final cover and title page of subcontract reports are prepared at NREL.

Scientific Notation

Standard scientific notation represents a number as a factor multiplied by a power of 10; 3,560,000 is expressed as 3.56×10^6. This is useful for very large and very small numbers, especially in non-SI units. You can also use certain standard prefixes, many of which are listed here with their abbreviations:

10^{24}	yotta	Y
10^{21}	zetta	Z
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a
10^{-21}	zepto	z
10^{-24}	yocto	y

We recommend choosing a prefix that permits the numerical value to fall between 0.1 and 1000 (62 kW rather than 62,000 W).

SI (Metric) System

NREL follows national policies and those of scientific societies by using the SI (Systeme International d'Unites; International System of Units) or metric system in expressing technical measurements. English units may follow metric ones or may be used alone in special cases, when this is appropriate for a publication's audience. See also Pacific Northwest National Laboratory's online guide, *Metrics the Right Way* (www.pnl.gov/ag/usage/metrics.html).

Solidus (Slant or Slash)

The solidus (or slash, slant, shilling mark, or virgule) is a versatile symbol that has mathematical as well as textual functions.

Using a Solidus in Fractions

Use a solidus to express a quotient in text when you do not need to use a displayed equation:

> These structures yield photoluminescence lifetimes that are related to bulk lifetime by the expression $1/\tau = 1/\tau_B + 2\ S/D$.

Use a solidus in superscript and subscript fractions:

> $x^{1/2}$.

Using a Solidus in Text

In text, use a solidus to indicate junctions, interfaces, and components:

> gas/liquid interface, 1-butyl acetate/acetic acid/water (3:1:1)

With abbreviated units of measurement, the solidus stands for "per":

> 2 g/cm^2
> 355 W/m^2

But spell out "per" when you spell out the units of measurement:

> several cubic meters per second; a few cents per kilowatt-hour

Sources

Include in your publication the source of all the figures and tables that were originally prepared and published by others, especially those outside NREL. If they are from a copyrighted publication, you may also need permission to reproduce them. Add the source at the end of a figure caption or in a note at the bottom of a table:

> Source: Hansen, W.L.; Pearton, S.J.; Haller, E.E. (1984). *Appl Phys. Lett.* 44:606.

Write out the source in full, as in the example, if it is not in your reference list or bibliography. If it is in the reference list, use one of these styles:

> Source: Hansen, Pearton, and Haller 1984.
> Source: Ref. 19. (when you use numbered references)

Standard Errors

Express standard measurement errors this way:

6.0 nm ± 0.2 nm

Tables

In small or average-sized tables, place a horizontal line (as wide as the table) under the title, a narrower one under column headings, and a wide one between the table and sources or notes, if any. Delete vertical lines and extra horizontal lines, unless the table is very large; in that case, inserting horizontal lines every three or four rows can help readers locate data. Example:

Table 1. Photovoltaic Power Production in Three Applications (megawatts)

Application	1986	1987	1988	1989	1990
Grid-Connected PV	0.5	0.2	0.6	0.4	0.4
Central Station PV	3.8	4.7	5.5	5.9	6.4
Consumer Products	0.5	0.6	0.8	2.5	2.2

Number tables in simple sequence in a paper, or by section in long reports (Table 1, Table 2, or Table 1-1, Table 1-2, and so on). Center the table title over the table (unlike a figure caption, which goes under the figure) and print the title in a bold font such as 10 pt. **Arial Bold**; print supplementary material in the title in a regular font (not bold). If possible, print the data in tables in a sans serif font such as Arial, Helvetica, or Univers rather than in Times Roman or another serif font. Define abbreviations in notes to the table if they are not obvious. Table notes are usually denoted by lowercase superscript letters ($^{a, b, c}$) rather than footnote numbers or asterisks.

Taxonomic Names

See *capitalization* and *italics*.

Temperature

Use a degree symbol (°) with temperatures expressed in the Celsius and Fahrenheit scales but not with kelvins (just use K). Don't leave a space between the number and the letter for °C and °F, but leave a space between the number and K.

Time

Use lowercase a.m. and p.m. to denote ante meridiem and post meridiem (before and after noon);

use a lowercase *s* (no apostrophe) to show the plural of a decade expressed with numerals (the 1990s).

Units of Measurement

Use numerals with units of measurement and time, even when the number is less than 10:

2 kW	7 cm^2
3 m	6 months
5 years	8-hour days
3 million	$2 billion
2950 Btu	60 Hz

Unless your profession, technical field, or scientific discipline specifies something different, use commonly accepted technical abbreviations. See also Pacific Northwest National Laboratory's online guide, *Metrics the Right Way* (www.pnl.gov/ag/usage/metrics.html as well as PNNL's guide to acronyms and abbreviations (www.pnl.gov/ag/usage/acronym.html).

Zero

In numbers less than one, place a zero before the decimal:

0.5
0.125
0.00125

Bibliography

American Chemical Society. (1978). *Handbook for Authors.* Washington, DC: ACS.

American Institute of Physics. (1976). *Editorial Handbook.* AIP Publication R-275. New York: AIP.

American Institute of Physics. (1978). *The American Institute of Physics Style Manual for Guidance in the Preparation of Papers for Journals.* AIP Publication R-283. 3rd edition. New York: AIP.

American Society for Testing and Materials. (1980). *ASTM Standard for Metric Practice.* ASTM E 380-79. Philiadelphia, PA: ASTM.

Bernstein, Theodore M. (1965). *The Careful Writer, A Modern Guide to English Usage.* New York: Atheneum.

Brusaw, Charles T.; Alred, Gerald J.; Oliu, Walter E. (1996. *Handbook of Technical Writing.* 7th edition. New York: St. Martin's Press.

CBE Style Manual Committee. (1978). *Council of Biology Editors Style Manual.* 4th edition. Published by the Council of Biology Editors.

Clements, Wallace; Berlo, Robert. (1979). *The Scientific Report: A Guide for Authors.* B-019, Rev. 2. Livermore, CA: Technical Information Department, Lawrence Livermore Laboratory, University of California.

Day, Robert A. (1998). *How to Write and Publish a Scientific Paper.* 5th edition. Phoenix, AZ: Oryx Press.

EG&G Idaho, Inc. (1979). *Format and Style for Technical Reports.* Idaho Falls, ID: EG&G Idaho.

Electric Power Research Institute. (1978). *EPRI Style Guide.* Palo Alto, CA: EPRI.

Follett, Wilson. (1966). *Modern American Usage.* New York: Hill and Wang.

Hodges, John C.; Whitten, Mary E. (1984). *Harbrace College Handbook.* 9th edition. New York: Harcourt Brace Jovanovich.

International Organization for Standardardization of Documentation. (1974). *International List of Periodical Title Word Abbreviations.* ISO 833-1974(e). ISO, Switzerland.

Lapedes, Daniel N., ed. (1978). *McGraw-Hill Dictionary of Scientific and Technical Terms.* 2nd edition. New York: McGraw-Hill.

Los Alamos Scientific Laboratory. (1977). *LASL Technical Information Manual.* Los Alamos, NM: Technical Information Group, Information Services Department, Los Alamos Scientific Laboratory of the University of California.

Northrup Corporation. (1970). *Technical Publications Writing Guide.* SP-794-809. Huntsville, AL: Northrup Corporation.

Rathbone, Robert R. (1985). *Communicating Technical Information.* 2nd edition. Reading, MA: Addison-Wesley Publishing Co., Inc.

Savolainen, A.; Feldmann, R.H.; Oliu, W.E.; Singh, M.H. (1979). *Technical Writing Style Guide.* NUREG-0650. Washington, DC: Division of Technical Information and Document Control, Office of Administration, U.S. Nuclear Regulatory Commission.

Sides, Charles H. (1991). *How to Write & Present Technical Information.* 2nd edition. Phoenix, AZ: Oryx Press.

Skillin, Marjorie E.; Gay, Robert M. (1974). *Words Into Type.* 3rd edition. Englewood Cliffs, NJ: Prentice-Hall.

Society for Technical Communication. (1976). *Typing Guide for Mathematical Expressions.* Washington, DC: STC.

Strunk, William, Jr.; White, E.B. (1979). *The Elements of Style.* 3rd edition. New York: Macmillan.

University of Chicago Press. (2003). *The Chicago Manual of Style.* 15th edition. Chicago: The University of Chicago Press.

U.S. Government Printing Office. (1973). *Style Manual.* Revised edition. Washington, DC: U.S. GPO.

U.S. Metric Association. (1976). *Metric Units of Measure and Style Guide.* USMA Publication 8. 11th edition. Boulder, CO: USMA.

Zinsser, William. (1990). *On Writing Well.* 4th edition. New York: Harper Collins Publishers.